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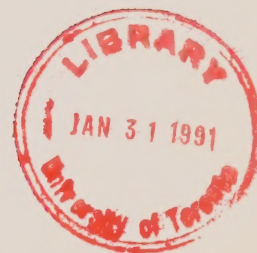
CONCENTRATION STATISTICS AS PREDICTORS
OF THE INTENSITY OF COMPETITION

by

John R. Baldwin¹ and Paul K. Gorecki²

No. 23G

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ABSTRACT

CONCENTRATION STATISTICS AS PREDICTORS OF THE INTENSITY OF COMPETITION

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John R. Baldwin¹ and Paul K. Gorecki²

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Business and Labour Market Analysis Group
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1. Department of Economics, Queen's University, and Research Fellow, Business and Labour Market Analysis Group, Statistics Canada.
2. Economic Council of Canada, and Business and Labour Market Analysis Group, Statistics Canada.

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ABSTRACT

Mobility statistics are direct measures of the intensity of competition; market structure indicators indirect measures. In this regard the most widely employed measure of market structure is the concentration ratio. Despite the fact that structural measures provide only proxies for the extent of competition, they are widely used by professional economic staff during the formulation and administration of competition policy. This paper investigates the appropriateness of this approach. It concludes that while concentration in Canada's manufacturing sector has remained constant, this masks considerable mobility. The implications of this result for competition policy and those who model firm behaviour are discussed.

KEYWORDS: Concentration Ratio, Competition, Mobility Statistics

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CONCENTRATION STATISTICS AS PREDICTORS OF THE INTENSITY OF COMPETITION

INTRODUCTION

Mobility statistics are direct measures of the intensity of competition. Measures of market structure are used to provide indirect measures of the same phenomenon. The most widely used measure of market structure that has been employed as a proxy for the intensity of competitive conditions in an industry is the concentration ratio. Despite the fact that structural measures provide only proxies for the extent of competition, they are widely used by professional economic staff during the formulation of and the administration of competition policy. This paper investigates the appropriateness of this practice.

It has long been recognized that concentration measures provide only a proxy for competitive conditions and may not capture the variety of competitive circumstances that exist. But few attempts have been made to measure the intensity of competitive conditions by a more direct measure -- the extent to which some firms replace others during the competitive struggle for dominance.

This reflects in part the assumption that high concentration industries have high barriers both to entry and to internal mobility, and that in low concentration industries the converse is true. For then the concentration ratio is an adequate proxy for the amount of turnover by industry -- adequate for the purposes of ranking industries on a relative scale but inadequate for reporting the true picture of the amount of turnover that continuously takes place. The lack of attention paid to mobility statistics also partially reflects the assumption that the factors that are likely to change the level of concentration -- shifts in demand, variability in demand, technical change also determine mobility. For then changes in concentration will be related in mobility. The validity of both assumptions is the subject of this paper.

CONCENTRATION STATISTICS AS THE CONVENTIONAL WISDOM

In the field of industrial organization, market structure is characterized as having considerable inter-temporal stability. This is based upon two inter-related but mutually reinforcing factors, one empirical, the other theoretical.

The measure of market structure that is most widely used in the U.S., the U.K., and Canada is a measure of concentration. The most commonly used concentration measure is the percentage of output (or any other indicator of industry size, such as employment or assets) accounted for by a small number of the largest firms -- typically four in North America. Measures of concentration capture characteristics of the firm size distribution at a point in time. The size distribution changes slowly over time and so do the associated measures of concentration. These results have been found in a series of U.S. studies, such as those by Adelman (1951) and Mueller and Hamm (1974), which have been summarized as follows by Scherer, in his widely used textbook:

to sum up, average industry concentration levels in U.S. manufacturing apparently increased quite modestly during the quarter century following World War II. Less solid evidence suggests that the increase was slight even when compared to the levels prevailing at the turn of the century. As Professor Adelman concluded in an earlier study of concentration trends, "Any tendency either way, if it does exist, must be at the pace of a glacial drift". (Scherer, 1980, p.70)

Schmalensee (1988, p.644), in his recent survey of industrial organization, reiterates this position when he refers to market structure as "relatively stable".

Canadian work falls squarely in the mainstream of the profession with its almost exclusive emphasis on concentration to measure market structure. Rosenbluth's classic studies (1955, 1957) for the NBER provided the foundation for a generation of research. Subsequent work, originating in the research group of the Bureau of Competition Policy (Canada, Department of Consumer and Corporate Affairs, 1971; Khemani, 1980), updated the work and continued to place its main emphasis on concentration. The Royal Commission on Corporate Concentration (1978), by its very title, shows the preoccupation of policy-makers with the size distribution of firms rather than with internal aspects of the competitive process. More recently, research for the Royal Commission on the Economic Union and Development Prospects for Canada (1988) continued to place the same emphasis on static market structure concepts (see Khemani, 1986) and not on dynamic market turnover characteristics that better demonstrate the strength of the competitive process.¹ While the latter do not go completely unnoticed, the continued reliance of tables of concentration statistics in these studies is indicative of their primary focus.

Canadian studies, like those done for the United States, give the impression that market structure changes are relatively unimportant since they show relatively slow changes in concentration in the manufacturing sector. In a study that examines the period from 1948 to 1972, Khemani (1980, Chart 4-2, Panel 1, p. 54) finds, for a sample of 57 comparably-defined industries, that the mean level of the four firm concentration ratio only increased from 44.4 per cent to 48.3 per cent. Marfels (1977), for a larger sample of 103 manufacturing industries taken from 1965 to 1972, reports little change in mean concentration levels. Krauss and Lothian (1988, p.1), in reviewing these and other studies for Canada, concluded "over time this analysis produced a body of statistics which concluded that up to the mid-1970s concentration though fairly high had remained constant".

The empirical generality that emerged from these concentration studies, both in Canada and abroad, was consistent with the "most influential" (Reid, 1987, p.11) paradigm used in industrial organization studies over most of the post-war period. Developed in the 1930s at Harvard by Mason and subsequently extended by Bain, the structure-conduct-performance (SCP) paradigm of industrial organization for a long time treated industry structure as being determined primarily by exogenous factors such as technology and public policies. Industry structure, in turn, influenced industry conduct and ultimately performance. This provided the framework that guided a number of case studies and, with the introduction of econometrics, many inter-industry cross-sectional empirical studies of the SCP relationship (Weiss, 1974). Canadian work in this area has tended to be an extension of American both in spirit and methodology.

Implicit in much of the discussion of the SCP was the view that the basic technical conditions that determine market structure, and thus market structure itself, change only gradually over time. To some extent, this was the result of the uni-directional flow of causation from structure to performance that was used. But it was also affected by the measures of concentration that were employed. While those who utilized the SCP framework recognized that market structure possessed several important dimensions -- the number and size distribution of sellers and buyers, product differentiation, entry barriers and others -- "the concentration characteristic, particularly with respect to sellers rather than buyers, has received by far the greatest attention" (Reid, 1987, p.12). This measure has varied little over time and its use, therefore, has contributed to the view that market structure is stable. The assumptions underlying the SCP paradigm and the finding of slowly changing industry concentration were mutually reinforcing.

This belief in the stability of industry structure and its impact on performance led in the U.S. to the proposal in 1968 by the Neal Task Force that

.....any industry in which the four biggest firms persistently accounted for 70 per cent of more of its output would have its structure compulsorily altered by the state, to be achieved by reducing the size of firms with each more than 15 per cent of the industry's output (Yamey, 1985, p.119).

This marked the zenith of the belief that the simple SCP model provided a guide for policy. In Canada, with a much less restrictive anti-trust policy that was based on concern over the trade-off between scale economies and concentration, such straightforward remedies were never deemed practical.

THE RELATIONSHIP BETWEEN STRUCTURE AND MOBILITY

Despite the preoccupation of industrial economists with stability rather than change, the existence of change has not been ignored. There are a number of recent developments that have placed much greater emphasis on market dynamics, on intra rather than interindustry, and on firm rather than industry analysis. The traditional unidirectional SCP model has been modified to consider feedback relationships between performance and structure; but these are still generally regarded as second order effects.

Moreover, it has long been recognized that market structure, as measured by concentration ratios, may be unchanging at the same time as there is considerable underlying change in the number and the size distribution of firms and the identity of the leading firms.

The shortcomings of the concentration ratio, both as a measure of market structure and as indicator of the degree of competition, have long been realized by those who used them.² Concern has been expressed that the concentration ratio may not reveal the extent of underlying change in the number and size distribution of firms or the identity of the leading firms. As a result of this concern, some have championed other measures of the size distribution of firms that were claimed to better capture the intensity of competition. Some have emphasized one aspect of the size distribution, such as the variance in the logarithms of firms' sizes (Hart, 1971, 1975 and 1979); others such as Hannah and Kay (1977) tried to

provide measures which better summarized several rather than one dimension of the size distribution.

A second response to the deficiencies inherent in concentration statistics has been to suggest that mobility indices better capture the impact of this dynamic process. They are direct measures of the manifestation of competition--the extent to which the successful supplant the unsuccessful. Here suggestions have been made for the use of indices that more directly measure fluctuations in market share and the rank of producers (Joskow, 1960; Hymer and Pashigian, 1962; Gort, 1963). Early work by Gort (1963) on changes in market share stability seemed to suggest that between 1947 and 1954, very little mobility took place. Although this post-war period is somewhat unusual, Gort's results have been used by Scherer (1980, p.74) to argue that mobility measures offer little information in addition to that provided by concentration statistics.

The calls for greater use of mobility measures has largely been ignored, partially because of these early results, and partially because of the easy availability from census publications of concentration ratios for a wide variety of industries; the feeling that this ratio is highly correlated with and, therefore, will capture other aspects of market structure; and its intrinsic attractiveness as a summary measure of the degree of competition. Most expositions of structure even today focus almost exclusively on concentration measures as opposed to the mobility measures that capture the extent of intra-industry movement.

The four-firm concentration ratio and other related market structure statistics are static measures of the size distribution of firms. They provide a picture of the outside of a box. Inside the box, the competitive process is at work as firms constantly vie for competitive advantage.

The conventional view has been that measures of the size distribution--the outside of the box--are sufficient statistics to describe the intensity of what goes on inside the box. In this view, mobility statistics, which characterize the internal workings of the box, do not add useful information to that which is provided by concentration statistics. Evidence of the conventional position can be found in the almost exclusive attention that has been focused on concentration statistics.

This paper investigates whether there is anything in the box that is not captured by looking at the outside.

AN EVALUATION OF CONCENTRATION STATISTICS

Concentration statistics were devised to produce summary measures of a complex phenomenon. Like most summary statistics, they reduce complex data to their bare essentials. They are intended to be used to provide a comprehensible representation that, despite its simplification, conveys an accurate impression of the underlying phenomenon. To this purpose, trends in concentration levels have been used to infer changes in the competitive environment; differences in levels of concentration across industries have been used to infer differences in the intensity of competition.

An evaluation of concentration statistics can adopt one of two approaches. It can ask whether the simple impression given by concentration statistics, when used as a summary representation of reality, is adequate in light of the picture provided by other data. Or it can abandon the treatment of concentration as a simple summary statistic to be used by itself and ask what information it provides in conjunction with other measures of the intensity of competition about the nature of the market system. While both of these separate but complementary approaches are useful, only the first is the subject of this paper.

CHANGE IN CONCENTRATION LEVELS

Examination of the outside of the box to make inferences about the degree of competition is a common practice by those who have examined trends in concentration to assess changes in the intensity of competition.³ Implicit in this approach must be the view that the more vigorous the competitive process, the greater the expected change in concentration.⁴ Mergers, entry, exit as well as the rise and fall of incumbents, should all lead to changes in the size distribution of firms and, hence, concentration. These changes may occur not only as a result of increases in international competition due to falling transportation costs and tariff barriers, technological change, and shifts in demand, but also because of oligopolistic interaction and the dynamics of market competition.

While studies for some industrial countries, such as that by Hart and Clarke (1980) for the U.K., have found periods when concentration has had marked trends up or down, this has not been the case for North America. Here the evidence suggests considerable intertemporal stability in concentration.

This section updates these earlier concentration studies of Canada's manufacturing sector. Data are presented at the 167 4-digit industry level for the years 1970 and 1979.⁵ A two-fold strategy is followed: first, trends are inferred by a comparison of mean levels of concentration at different points in time; second, changes in individual industry concentration indices through time are estimated and summary statistics presented. As noted above, concentration is but one measure of structure. Hence, a brief comparison is made with the stability of other indices of structure and other methods of characterizing the size distribution of firms. Before measuring concentration change, however, some discussion of the appropriate index is needed.

1) Measuring Concentration.

One of the longest standing debates in industrial economics concerns the appropriate method of summarising the size distribution of firms in an industry in order to characterise the intensity of competition.⁶ The literature is replete with indices named after their originators--Herfindahl, Hall-Tideman, Horvath, and Hannah and Kay. Such a vigorous search for the optimal measure reflects a number of factors: the lack of a generally accepted theoretical model that links structure to behaviour to performance from which such an index can be derived; and the fact that in the absence of such a model--and no doubt partly explaining it--different people do not always attach the same weight to the various dimensions of market structure.

Despite a lack of consensus as to which market structure index is superior, there is widespread agreement that the index should take into account at least two dimensions of the size distribution of firms: the number of firms and the inequality or variance in the size of firms. This reflects the generally held view that such changes are likely to increase the dominance of large firms and make the industry more oligopolistic. Therefore, many indices have the property that they increase if either the number of firms falls or the degree of inequality in firm size increases.

Indices of market structure have been divided into two broad groups: discrete and summary.⁷ They differ in the set of points from the size distribution of firms that are used to derive the index. The discrete measures use data on the market share of a small number of the largest firms. The widely used concentration ratio (CR) makes use of the leading four (CR4) or eight (CR8) firms. In contrast, the summary measures, as the name implies, use all the data points in the size distribution. The summary indices differ one from another primarily in how they weight the individual firms' market shares. The Herfindahl index weights each market by itself, while the Entropy index uses the log of share as the weight. Other comprehensive summary measures include those proposed by Horvath (1970), Hall-Tideman (1967), and Hannah and Kay (1977).

Several criteria can be used to select indices of market structure. When economic theory is used, the approach has been to postulate a behavioural relationship (e.g. Cournot) and to derive an identity that links a measure of structure and performance. Some have derived the Herfindahl index (Cowling and Waterson, 1976; Stigler, 1964) and others, the discrete indices, particularly the concentration ratio (Svingen, 1970). This approach does not try to link structure to performance directly. Instead, it links behaviour to performance; an index of structure that is related to performance results from the analysis. Since it is not known, in general, what the appropriate behavioural assumption for a particular industry should be, nor how it relates to structure, it is difficult to select an assumption and, therefore, an index that is appropriate for all industries.

Alternatively, a set of axiomatic criteria can be used to derive the concentration index. Unfortunately, it is difficult to obtain general agreement on the set of criteria to be used. One index based on axiomatic criteria is that proposed by Hannah and Kay (1977). It satisfies seven axioms. These include: concentration should increase because of mergers or if the Law of Proportionate Effect (LPE) holds; it should decrease if there is entry of firms that are below some size threshold. The Hannah and Kay index is related to the Entropy index, and, under certain circumstances, reduces to the numbers equivalent of the Herfindahl index.

In this section, one discrete--the four-firm concentration ratio (CR4)⁸--and one summary statistic--the Herfindahl (HF)--are selected to evaluate trends in the size distribution of firms. The CR4 and HF were chosen because they not only have some theoretical underpinning, but also because such ratios, particularly the CR4, are often produced by statistical agencies and this facilitates comparisons with earlier studies.⁹

II) The Stability of Canadian Concentration Levels.

While measures of concentration were devised primarily to evaluate differences across industries in the competitive environment, changes over time have been used to analyze long term trends in the competitive environment. When this is done for the Canadian manufacturing sector, very little change appears to be taking place. The mean level of concentration of Canadian 4-digit manufacturing industries moved imperceptibly in the 1970s. Over the decade 1970 to 1979, the mean proportion of industry shipments accounted of the leading four firms declined by 1.05 percentage points from 50.91 per cent to 49.86 per cent. The distribution around the mean, measured by the standard deviation, also showed little change (Table 1). The same picture of stability was given by the CR8 and HF.¹⁰

Since the CR4 and CR8 measures involve an arbitrary selection of the number of firms used to create a summary statistic of concentration, the analysis of trends in mean levels of concentration was taken one step further. The CR1 to CR10 were estimated for each of the 167 4-digit Canadian manufacturing industries. The mean level of CR1, CR2....CR10 in 1970 and 1979 for these industries is presented in Figure 1. It is evident that the stability shown by the CR4 and CR8 is not some quirk of the particular number of firms selected to define concentration. It holds for all of the CR measures.

The use of trends in the mean value of concentration may hide considerable underlying change in the concentration levels of individual industries. In order to see whether this was the case, the ratio of industry concentration in 1979 to 1970 was calculated. Its mean across the four-digit sample was 1.0007. The corresponding ratios for CR8 and HF also had mean values very close to unity (Table 1). This provides further evidence of the stability of market structure.

Despite this evidence of stability, the structure of Canada's manufacturing industries in the 1970s has not been completely rigid. There is some inter-industry variability in the ratio of 1979 to 1970 concentration. To characterize the extent of change, a transition matrix was estimated that shows the number of industries moving from one concentration class to another. Industries were assigned to a concentration class in 1970 and 1979 using a four-fold classification system that divides industries into the following CR4 classes: highly concentrated oligopoly (1.00-0.75); moderately concentrated oligopoly (0.50-0.749); slightly concentrated (or low grade) oligopoly (0.25-0.499); and atomism (0-0.249).¹¹ Similar classification systems exist for the HF index.¹² However, in view of the similarity in findings, only tabular results for the CR4 are presented here.

The cross-tabulations, using the above classification system for CR4, are presented in Table 2. The table confirms the existence of considerable market structure stability. Of the 167 industries, 79 percent or 132 remained in the same CR4 class. In the case of the threefold HF classification, 81 percent or 135 remained in the same HF class. Furthermore, of those industries that did change concentration classes, movement was almost always to an adjacent class. Only one industry moved more than one class and this only occurred using the HF concentration grouping.

III) The Stability of Other Structural Indicators.

Characterising the outside of the box using the concentration ratio suggests that it changes very little in dimension. However, there are other ways of representing the external dimensions of the box. Some, such as the cost structure, are quite separate from concentration. Others, while based on the size distribution of firms, refer to different aspects of that distribution thought to better measure of the intensity of competition. Reliance has usually been placed on concentration as the indicator of structure because it was thought to be a useful proxy for these other dimensions. This section examines whether these other indices also confirm the pattern of stability portrayed by the CR4 and HF.

Concentration measures, such as the CR4 or HF, are designed to incorporate at least two dimensions--the number of firms and their inequality--of the size distribution of firms. There are, however, a number of other measures of the size distribution that rely only on one aspect of it.¹³ Proponents of these measures feel they better capture the intensity of competition, either when used separately or in conjunction with the traditional measures. Some of these measures focus only on inequality--such as the variance of the size of all firms (VARS),¹⁴ the Pareto coefficient (PAR) used to characterise inequality in the upper tail of the distribution,¹⁵ or the coefficient of variation of the leading eight firms (CVAR8).¹⁶ Others are concerned with the number of competitors. Numbers of competitors can be used in absolute form (NF, NP) or when used as a quotient to divide the numbers equivalent derived from some concentration measure, they provide a relative measure. These relative number variables vary inversely as the numerical importance of small firms increases relative to the numbers equivalent and, therefore, measure the extent to which small firms are numerically important.¹⁷ Still others have advocated the use of the marginal concentration ratio--the share of the firms ranked 5 to 8 (MCR8)¹⁸--or the size of this group relative to the top 4 (REL84) to capture the importance of competition from a secondary group firms.

Market structure is also sometimes described with measures that are not derived directly from the size distribution of firms. Such measures include cost structure (CST), Canadian ownership (CDN), and minimum efficient sized plant as a percentage of industry size (MES). Some of these can be classified as entry barrier variables. As such they are likely to influence the size distribution of firms and can be regarded as proxies for concentration.

The impression of stability in market structure that the CR4 and HF convey is also found with respect to many of these other dimensions of structure--Table 3. Even though, these secondary measures of concentration exhibit slightly more change than either CR4 or HF (see Table 1) they have generally changed by only a few percentage points over the decade. The median values of the ratio of 1979 to 1970 vary generally between 0.90 and 1.12.

INTRA-INDUSTRY MOBILITY

The outside of the box does not appear to have changed much in the 1970s. True a corner may have become a little rounded, an edge a little more keen. However, in order to detect these changes, a microscope would be needed. Not so with the change inside the box. The degree of stability on the inside may be contrasted with the view of the outside by using two of the measures developed and used elsewhere (Baldwin and Gorecki, 1989). The first is

the magnitude of the size of the market share transferred from losers to winners over the 1970s. The second is the strength and direction of the relationship between a firm's market share in 1970 and 1979.¹⁹

I) Magnitude of Market Share Change.

The magnitude of market share change in an industry was measured using the instability index.²⁰ This index captures the degree to which market share is transferred among firms. The index is estimated by taking one-half the sum of the absolute difference in each firm's market share between two points-1970 and 1979, in this case. The greater the value of the instability index, the greater is the magnitude of market share transferred. The maximum value of the index is 1; the minimum value is 0.

On average, thirty-two percentage points of market share were transferred from firms that lost market share to those that gained it within a 4-digit industry. The minimum value was 0.06, the maximum 0.72, with a standard deviation of 0.14. These numbers suggest that a considerable amount of underlying change occurs within an industry and that the value of the index varies considerably across industries. It is certainly substantially more than the one percentage point by which the market share of the top 4--the CR4--declined over the decade of the 1970s.

Total turnover of market share was decomposed into the change occurring in continuing firms (TURNC), and the change due to greenfield entrants and closedown exits (TURNE). Total share change over the decade of the 1970s was about equally divided between TURNE and TURNC--15.7 and 16.6 per cent, respectively. The turnover due to entry and exit (TURNE) exhibits more inter-industry variation than that of turnover due to expansion and contraction of incumbents (TURNC)--the standard deviations were 12 and 7 per cent, respectively. The correlation between TURNE and TURNC is statistically insignificant and quite low in value: - 0.0037.

II) The Direction and Strength of Market Share Change.

Others have emphasized that it is not just the amount of market share that is being shifted but also the pattern of change in shares that is important.²¹ Gort (1963, p.51), for example, emphasized that in evaluating the degree of competition, the ability of leading firms to maintain their market share, "is probably more significant than the extent of concentration at a single point in time." It is thus not just the magnitude of change as much as the pattern--in particular, the extent to which the largest firms decline and the smallest grow--that may determine the amount or renewal that takes place in an industry. Regression and correlation techniques applied to shares at two different points in time provide a way of summarizing this pattern.

Two indices are used here to determine whether the picture of market share stability of the top four firms applies across all firms in an industry. The first, CORSH, is the correlation coefficient of the firm's market share in 1970 and 1979; the second, REGSH, is the regression coefficient relating 1979 market share to 1970 market share in a simple bivariate relationship.²² The correlation coefficient (CORSH) measures the degree to which market shares at one point are linearly dependent on those at another point and is directly related to

the coefficient of determination in a bivariate regression. As such, it can be taken to represent the extent to which the residual error of prediction is large or small. The stronger the dependence, the closer the index is to unity and the smaller are the residual errors. The index REGSH reflects the extent to which firms, on average, regress towards the mean (REGSH less than 1), experience no change (REGSH=1), or the extent to which centrifugal forces cause large firms to get larger relative to small firms (REGSH greater than 1).

A high value of CORSH--for this purpose, defined as 0.90 to 1.00--is consistent with REGSH showing that firms generally lose, gain or maintain their relative position. Equally, REGSH may indicate stability--0.90 to 1.10--but the strength of the linear relationship between market shares may be very weak. (i.e., CORSH is low) Hence, industries with high values of CORSH and with REGSH centred on unity are defined here as those where market share can be said to be stable. In order to examine the extent to which this is the case, a two-way classification of CORSH and REGSH was performed using the bounds .9 to 1 and .9 to 1.1, respectively.²³ The results are presented in Table 4. There are only 23 or 14 per cent of Canadian manufacturing industries where both of these two conditions for stability are met--bottom right quadrant of Table 4. In more than half the cases where REGSH suggests stability, CORSH is low rather than high--top right quadrant. Stability in market shares, based on both REGSH and CORSH, is the exception rather than the rule.

III) Concentration and Mobility

The picture that mobility statistics give is one of substantial intra-industry change, as entry, exit, growth and decline occur. By itself, these data are revealing. Concentration statistics yield a very different picture of the world. They tend to remain relatively constant and, therefore, give the impression of a static universe. While it is possible to find some movement in concentration indices, the amount of change is small over a decade relative to what is taking place within each industry.

It still, of course, may be that concentration changes are strongly related to the turnover that occurs within an industry. If so, these changes would adequately summarize the dynamics of change. To test this, all 167 4-digit industries were ranked on the basis of the amount of concentration change -- using the difference between 1979 and 1970 four firm concentration ratios. The industries were then grouped equally into 8 classes on the basis of the amount of concentration change and the average turnover ratios for entry and exit (TURN_E) and for continuing firms (TURN_C) were calculated for each group. These are plotted in Figure 2 where the groups are arranged from left to right in ascending order of concentration change -- with the leftmost observations representing decline in concentration and the rightmost points representing increases in concentration.

There is no simple linear relationship between the turnover measures and changes in concentration. If anything, there is a U-shaped relationship between total turnover and concentration change. It does appear that where concentration fell most, turnover from entry and exit was largest; where concentration increased most, turnover was greatest in the continuing sector. But it is also the case that where there was virtually no concentration change, there was also considerable turnover. Concentration change may be indicative of underlying turnover; lack of concentration change is not.²⁴ It is, therefore, best to concentrate

directly on the amount of internal mobility than to rely on concentration measures which provide a misleading picture of the amount and type of change taking place within an industry.

CONCENTRATION AND MOBILITY AS INDICATORS OF THE STATE OF COMPETITION

Concentration, the outside of the box, can be used in a number of ways to infer the extent of intra-industry change. Assessing trends in concentration, as in the previous section, is only one of the ways in which concentration indices are employed. Concentration indices are also used to rank industries according to the degree of competition. Since mobility indices provide another metric, it is important to ask whether they rank industries quite differently than do concentration measures. Therefore, the following section examines whether both indices of competition rank industries in the same way. It asks whether the outside of the box provides sufficient information on industry ranking that resort need not be made to the contents of the box.

This question, initially, is examined in two ways: first, by correlating mobility and concentration; and second, by examining the pattern of mobility across different market structures. Attention then turns to whether concentration and mobility indices do an equally good job of identifying a subset of "problem" industries, since interest in concentration indices often centres on their ability to isolate industries where the competitive process is most likely to malfunction.

1) Does Concentration Predict Mobility?

In considering whether concentration and mobility statistics rank industries in a similar way, rank and simple correlation coefficients were used.²⁵

For the correlation analysis, total turnover of market share is decomposed into the change occurring in continuing firms (TURNC), and the change due to greenfield entrants and closedown exits (TURN E). This decomposition is useful since the two sources of turnover have been treated as having very different effects on the intensity of competition. There is a long-standing tradition in industrial economics to treat oligopoly and entry models quite separately.

All the mobility indices presented so far (TURN E, TURN C, CORSH, REGSH) are included as well as one addition. Both high and low values of REGSH indicate instability, while stability is to be found in those values centred on unity. Since interest is not only in the direction of change, but also in its magnitude, STAB1 is defined as the absolute value of (REGSH - 1). The lower the value of this index, the greater the degree of stability in market shares.

The relationship between concentration in 1970 and mobility estimates for the period 1970 to 1979 is presented in Table 5. Concentration levels for 1970 were used since our purpose is to ask whether concentration can be used to infer the subsequent intensity of competition as evidenced by mobility indices.

The signs of the correlation coefficients in Table 5 indicate that if an industry is ranked highly in terms of concentration, then it also has higher stability; moreover the Spearman correlation coefficients are significantly different from zero, using a 5 per cent significance level, for three of the five mobility variables--TURNE, TURNC, and CORSH. There is less turnover and more linear dependence between the market shares for highly concentrated industries. However, concentrated industries are not likely to exhibit significantly less regression toward the mean or greater stability of market share--REGSH and STAB1, respectively.

The two sources of turnover have about the same quantitative importance over the decade being measured here. The highest correlation (-.59 to -.57) exists between concentration and the turnover associated with entry and exit (TURNE); there is a much lower correlation (-.20 to -.18) between concentration and turnover in the continuing sector (TURNC). The relationship of concentration with one half of total turnover is, thus, quite different than with the other half.

While significant correlations are found between concentration and three mobility measures, the correlations are not high and they differ considerably for the different mobility measures. Furthermore, for the remaining two mobility measures the correlations with concentration are not significant. Even in those cases where a statistically significant correlation coefficient was found, concentration only "explained" or accounted for a small percentage of the variance of the mobility measure--about a third in the case of the 1970 CR4 and TURNE. The outside of the box, therefore, does poorly in predicting the variety of contents inside of the box.

II) Concentration Classes and Their Mobility Experience.

Correlation analysis performed across a broad cross-section of industries may miss non-linear patterns in the data. For example, the relationship between concentration and continuing firm turnover across the entire sample may be low, but there may be a significant difference between turnover in highly concentrated and less concentrated industries due to clustering at different mean levels.

In order to examine this possibility, the average values of the mobility measures were calculated for groups of industries ranked by concentration class. The same market structure classification system is adopted that was used earlier to divide industries into groups based on their CR4 values. The mean and standard error of the mean [in square brackets] for each of these groups are presented in Table 6. It is evident that most of the variation in market share turnover across concentration classes comes from entry and exit (TURNE) rather than share gain and share loss in the continuing sector (TURNC). The difference between the two is evident in Figure 3 which graphs the means and a 95% confidence interval for each.

An analysis of covariance test was also employed to examine if there are significant intergroup differences for both of these mobility measures. In the case of entry and exit turnover, the mean of TURNE in each concentration class was significantly different from the adjoining one. In the case of continuing firm turnover, TURNC, each of the bottom three concentration classes were found to be different from the top class; but similar to one another.

Thus, while entry and exit turnover declines significantly across all concentration classes, continuing firm turnover only does so for the largest class.

There is a second reason for presenting the averages of the mobility measures by concentration class. A major criticism of the concentration index has been that any level of concentration may be consistent with a wide range of mobility patterns. Industry growth rates, their variability and other mobility characteristics are likely to vary considerably for industries with a given value of concentration. The data confirm that this is the case.²⁶ For example, while the mean values of entry and exit turnover (TURNE) in the two most concentrated industry groupings are 7.9 and 12.4 per cent, the standard deviation (in round brackets) is 9.7 per cent in both cases. This is large relative to the values ranged along the locus of points that join the means of the top two groupings. While it is true that there is enough between-group variation relative to the total variation in the sample that the differences in group means are deemed to be significant, this should not obscure the basic point. There is considerable variation in the turnover measure within each concentration group.

III) Problem Industries: Do Concentration and Mobility Indices Provide the Same Set of Answers?

The previous sections have examined the extent to which concentration and mobility are related in a broad cross-section of industries. Concentration was shown to be only imperfectly related to mobility. Concentration measures, then, cannot be relied on to adequately describe the intensity of competition. These conclusions pertain to the pattern calculated across all industries.

Not everyone has used concentration statistics to rank all industries along a continuous scale from those where competition was least intense to those where it was most intense. A number of writers have examined the extent to which there was a critical concentration ratio that grouped industries into two classes--into those with a monopoly or oligopolistic problem and those with no such problem.²⁷

This section examines the extent to which concentration and mobility measures yield the same set of problem industries. The CR4 classification introduced earlier was used to define potential problem industries--those with a 1970 CR4 between 75 and 100 per cent. This led to the identification of 35 "problem" industries.²⁸ In order to compare the results given by the CR4 and the mobility indices, all industries were ranked using each of these measures. A high rank using the 1970 CR4 indicates the industry is more rather than less concentrated; a high rank for the mobility indices denotes stability. If the top 35 ranked industries are the same using the 1970 CR4 and the various mobility indices, then mobility statistics would add little that is not already captured by concentration data.

Since there are a number of different interpretations that can be attached to stability, several mobility measures are employed. Four indices--TURNE, TURN, STAB1 and STAB2--are used. The latter is a combination of CORSH and REGSH. Because REGSH is a coefficient estimated from a regression analysis, it is imprecise--especially in comparison to the precisely measured variables TURNE and TURN. Using it to order industries on a continuous basis attributes more precision to individual observations than is warranted. In

order to use it to rank industries, information on the precision of the estimate was used. STAB2 is a dummy variable equal to unity when REGSH suggests stability in market shares (REGSH .9 to 1.1) and the fit was good (CORSH .9 to 1). There are 23 industries for which STAB2 is equal to unity--those in the bottom right quadrant of Table 4. In all other instances, STAB2 is set equal to zero.

Table 7 provides data on the degree to which the same problem industries are found using the 1970 CR4 and these mobility indices. The 35 problem industries using the 1970 CR4 are ranked from one to 35 in column 1, with the remaining columns giving the overall rank of each of these 35 industries using the four mobility indices. The first row indicates, for example, that the industry with the highest level of concentration in 1970 was ranked number four in terms of TURN, but 54th in terms of TURNE. In contrast, the 31st ranked industry using the 1970 CR4 is ranked 24th using TURNE and 67th using TURN, but was one of the few industries in the top 35 with STAB2 equal to unity.

It is evident that the same set of problem industries is not provided by both concentration and mobility statistics. The penultimate row of the table shows that typically a substantial percentage of the 35 problem industries were not ranked in those 35 industries having the greatest stability. The most noticeable exception is TURNE which ranks 21 in the top 35. This confirms that the strongest relationship is between concentration and entry. The final row of the table is an attempt to gauge the magnitude of the difference in ranks. It is simply the mean rank of the 35 problem industries for the various indices in the table. For CR4 it is 18; but for TURNE and TURN, it is much larger. The ranks of the mobility indices are quite different from those yielded by the CR4. It must be concluded that concentration statistics do a very imperfect job of measuring the intensity of firm turnover brought about by the competitive process.

CONCLUSION

This paper has reviewed the impression of the degree of competition given by concentration statistics for Canada's manufacturing sector in the 1970s and compared this image to that generated by an examination of mobility statistics. Since both the levels and changes in the levels of concentration statistics are used to infer the intensity of competition, each is examined separately.

The picture that emerges from an examination of changes in these structural indicators is one of considerable stability. This finding accords with earlier studies of trends in concentration for the U.S. and Canada. This picture of stability does not reflect the degree of competition that is taking place--what is actually going on inside the box. Contrary to the impression given by concentration measures, mobility statistics suggest considerable change and instability.

This paper has also investigated whether the use of the levels of concentration yielded imperfect information about the degree of mobility by examining the extent to which the two sets of measures are highly correlated and whether they produce the same list of "problem" industries--industries where competition may be constrained. Once again, con-

centration statistics were found to do a poor job of ranking industries on the basis of the amount of change going on inside those industries.

The cause of the inadequacy of concentration measures is straightforward. It is primarily due to the fact that there is more than one dimension to the competitive process. Inter alia, these dimensions include the extent to which firms change ranks, larger firms regress towards the mean, entry and exit is important, and whether much market share is redistributed among continuing firms. Concentration is related more closely to some of the mobility measures than others. Used alone, concentration statistics cannot hope to adequately capture these dimensions. Used in conjunction with mobility variables, concentration statistics can provide a useful guide as to which industries competition authorities might best focus their attention.

In sum, the impression of change in the size distribution of firms is quite different depending on whether the inside or outside of the box is examined. A scholar looking at the outside of the box might decide to design models of industry behaviour that emphasized reasons for stability, such as market sharing arrangements, as well as incumbent behaviour that seemingly is able to deter entry. Attention would be devoted to equilibrium games with static solutions. In contrast, a scholar who peers inside the box would focus on those factors leading to entry and exit as well as the rise and fall of incumbents. Such a scholar would acknowledge the necessity of not only modelling incumbent behaviour toward entrants, but also how incumbents interact with each other. Furthermore, given the magnitude of share change and the lack, in many cases, of any pattern to this change, any model of firm behaviour would have to incorporate some notion of the considerable uncertainty of market outcomes.

The results of this paper can serve not only as a guide to theorists but also to practitioners of competition policy. Concentration and mobility have been treated as substitutes, rather than complements. This, in part, reflects the preoccupation of the profession to find a relatively simple concentration measure for use as a straightforward index to gauge the state of competition. The intensity of competition in the real world is not amenable to simplification because of the variety of events occurring within individual industries. The concentration and mobility indices are related but only imperfectly. They reveal different aspects of the competitive process. Therefore, in order to detect those industries where competition problems may arise, both mobility and concentration indices can be used together. For example, it might be hypothesized that competitive problems are most likely to occur in those industries which are highly concentrated and where there is evidence of successful collusion among incumbents to both stabilize their market share and deter entry. This can be translated into the rule that the industry must be in the top 35 on the basis of each of concentration and turnover measures chosen to be most important. Those administering competition policy might usefully use both concentration and mobility indices.

NOTES

1. The Royal Commission on Corporate Concentration (1978) spent considerable resources trying to establish the direction of the trend in concentration. See Marfels (1977).
2. These shortcomings, both measurement and conceptual, may be found in a number of places. See, for example, Bain (1968, pp.124-133) and the papers by Miller as well as Conklin and Goldstein in National Bureau of Economic Research (1955).
3. In the Canadian case, both the Royal Commission on Corporate Concentration (1978) and Khemani (1986) have examined trends in concentration as part of an attempt to assess changes in the competitive environment.
4. See, for example, Adelman (1951) and Mueller and Hamm (1974).
5. Using the concentration ratio for 1975 as well confirms the picture of stability revealed by the use of the index for just 1970 and 1979.
6. There is an extensive literature on this subject. See, for example, Marfels (1971), Aaronovitch and Sawyer (1975, pp.59-90), Curry and George (1983) or Waterson (1984, pp.166-174).
7. See Waterson (1984) for this classification.
8. Occasionally, the CR4 is supplemented herein with the CR8 ratio.
9. A principal component analysis, that was conducted on various measures of the size distribution of firms, suggested that the summary and discrete measures were about equally weighted in the first principal component. In other words, they were all capturing the same dimension of the firm size distribution.
10. Weighted concentration measures were also estimated, using industry value added as weights. The same pattern of stability was found, but the change was somewhat greater. For example, the weighted CR4 fell from 0.4952 in 1970 to 0.4638 in 1979.
11. See Bain (1968, pp.136-138). Green (1980, p.45), and Canada, Department of Consumer and Corporate Affairs (1971, p.21) applied the classification scheme to Canada.
12. The HF classification follows that employed by the U.S. Department of Justice (1982) in its merger guidelines. It used a threefold classification: highly concentrated industries -- where competitive problems are likely to arise (0.1800 - 1.00); industries where "competitive concerns associated with concentration become significant to the point at which they become quite serious." (0.1000 - 0.1799); and markets which are likely to perform quite well (0.0000 - 0.0999).
13. Many of these are defined in the references cited in footnote 6 above.

14. See, for example Hart (1971, 1975 and 1979).
15. Simon and Bonini (1958) proposed this measure.
16. This has been used by Caves et al. (1980, p.229) in conjunction with the CR4.
17. These numbers equivalent measures are divided by NF to form the relative number indices. The numbers equivalent indices are defined as the number of equal sized firms than would be required to derive the given value of an index. See Adelman (1969) for a discussion of the HF numbers equivalent.
18. The MCR8 has been used by Miller (1971).
19. For a discussion of the data, see Baldwin and Gorecki (1990). In measuring mobility, individual firm's market shares in 1970 and 1979 are used. An important issue concerns whether account should be taken of changes due to mergers and acquisitions. In this paper it was decided to ignore such influences with respect to mobility here. If mergers had been included, there would have been substantially more mobility; entry would have increased relative to incumbent activity. See Baldwin and Gorecki (1989).
20. See Hymer and Pashigian (1962) for an early use of a variant of this statistic.
21. See Kalecki (1945), Steindl (1965), Prais (1976), Gort (1963) and McGuckin (1972).
22. In order to estimate the coefficient relating 1979 and 1970 market share, the classic technique for errors in variables was used -- the coefficient was estimated as the geometric mean of the regression of 1979 on 1970 market shares and the reciprocal of the regression of 1970 on 1979 shares. Gort (1963) also used this method.
23. These are used because they correspond to the bounds used by Gort (1963). Alternatively, using significance tests to count only industries where REGSH is significantly less than one does not change the qualitative conclusion.
24. Earlier work by McGuckin (1972) on the relation between entry and concentration finds a similar result.
25. In view of the similarity between the two, only the rank or spearman correlation coefficients are presented here.
26. Similar results were found if the HF classification detailed in footnote 12 was used instead.
27. See the discussion in Scherer (1980, pp.279-80). This literature attempts to determine the critical concentration ratio by finding that ratio at which there is a break in the concentration-profits relationship.

28. Use of the HF classification scheme led to the identification of 34 problem industries. With one exception, these problem industries were identical to those found using CR4.

REFERENCES

Aaronovitch, S. and Sawyer, M.C., 1975. Big Business: Theoretical and Empirical Aspects of Concentration and Mergers in the U.K. Macmillan: London

Adelman, M.A. 1951. "The Measurement of Industrial Concentration". Review of Economics and Statistics. 33: 269-296.

Adelman, M.A. 1969. "Comment on the 'H' Concentration Measure as a Numbers Equivalent," Review of Economics and Statistics. 51: 99-101

Bain, Joe S. 1968. Industrial Organization. Second Edition. New York: John Wiley.

Canada. Department of Consumer & Corporate Affairs. 1971. Concentration in the Manufacturing Industries of Canada. Ottawa: the Department.

Baldwin J.R. and P.K. Gorecki. 1989. "Measuring the Dynamics of Market Structure," Annales d'Economie et de Statistique. No. 15/16.

Baldwin J.R. and P.K. Gorecki. 1990. Measuring Entry and Exit in the Canadian Manufacturing Sector Using Longitudinal Data: Methodology," in A.C. Singh and P. Whitridge, eds. Analysis of Data in Time, proceedings of a conference sponsored by Statistics Canada. Ottawa: Supply and Services Canada.

Caves, R.E., M.E. Porter, A.M. Spence, with J.T. Scott. 1980. Competition in the Open Economy: A Model Applied to Canada. Cambridge, Mass.: Harvard University Press.

Canada. 1978. Royal Commission on Corporate Concentration. Report. Ottawa: Minister of Supply and Services.

Canada. 1988. Royal Commission on the Economic Union and Development Prospects. Report. Ottawa: Minister of Supply and Services.

Cowling, K. and Waterson, M. 1976. "Price-Cost Margins and Market Structure", Economica, 43: 767-74.

Curry, B. and K.D. George. 1983. "Industrial Concentration: A Survey," Journal of Industrial Economics. 31: 203-55.

Goldshmid, H.J., H.M. Mann & J. F. Weston. eds 1974. Industrial Concentration: The New Learning Boston: Little Brown.

Gort, M. 1963. "Analysis of Stability and Change in Market Shares," Journal of Political Economy. 62: 51-61.

Green, C. 1980. Canadian Industrial Organization and Policy. 2nd Edition, Toronto: McGraw-Hill Ryerson.

Hall, M. and N. Tideman. 1967. "Measures of Concentration," Journal of the American Statistical Association. 62: 162-8.

Hannah, L. and J.A. Kay. 1977. Concentration in Modern Industry. London: Macmillan.

Hart, P.E. 1971. "Entropy and Other Measures of Concentration," Journal of the Royal Statistical Society. Series A. 134: 73-85.

Hart P.E. 1975. "Moment Distributions in Economics: An Exposition," Journal of the Royal Statistical Society. Series A. 138: 423-34.

Hart, P.E. 1979. "On Bias and Concentration", Journal of Industrial Economics, 27: 211-16.

Hart, P.E. and Clarke, R., 1980. Concentration in British Industry 1935-75 London: Cambridge University Press.

Horvath, J. 1970. "Suggestion for a Comprehensive Measure of Concentration," Southern Economic Journal. 36: 446-52.

Hymer, S. and P. Pashigian. 1962. "Turnover of Firms as a Measure of Market Behavior," Review of Economics and Statistics. 44: pp. 82-87

Ijiri, Y. and H. Simon. 1977. Skew Distributions and the Sizes of Business Firms. Amsterdam: North-Holland.

Joskow, J. 1960. "Structural Indicia: Rank-Shift Analyses as a Supplement to Concentration Ratios," Review of Economics and Statistics, 42: 113-116.

Kalecki, M. 1945. "On the Gilbrat Distribution", Econometrica, 13, 161-170.

Khemani, R.S. 1980. Concentration in the Manufacturing Industries of Canada: Analysis of Post-War Changes, Ottawa: Supply and Services Canada.

Khemani, R.S. 1986. "The Extent and Evolution of Competition in the Canadian Economy," in D. McFetridge ed Canadian Industry in Transition, Toronto: University of Toronto Press, 135-76.

Krause, W. and J. Lothian. 1988. "Measurement of and Recent Trends in Canada's Level of Corporate Concentration." Paper presented at the American Statistical Association Conference, New Orleans, August.

Marfels, C. 1971. "A guide to the Literature on the Measurement of Industrial Concentration in the Post-War Period," Zeitschrift fuer Nationaloekonomie. 31: 483-506.

Marfels, C. 1977. Concentration Levels and Trends in the Canadian Economy, 1965-1973. Study #31 for the Royal Commission on Corporate Concentration. Ottawa: Minister of Supply and Services.

McGuckin R. 1972. "Entry, Concentration Change and Stability of Market Shares", Southern Economic Journal, 38: 363-370.

Miller, R.A., 1971. "Marginal Concentration Ratios as Market Structure Variables", Review of Economics and Statistics, 53: 289-93.

Mueller, W.F. and Hamm, L.G., 1974. "Trends in Industrial Concentration", Review of Economics and Statistics, 56: 511-20.

National Bureau of Economic Research 1955. Business Concentration and Price Policy. Princeton: Princeton University Press.

Prais, S.J. 1976. The Evolution of Giant Firms in Britain. Cambridge: Cambridge University Press.

Reid, G. 1987. Theories of Industrial Organization. Oxford: Basil Blackwell.

Rosenbluth, G. 1955. "Measures of Concentration" in N.B.E.R., 57-95.

Rosenbluth, G. 1957. Concentration in Canadian Manufacturing Industries. Princeton: Princeton University Press.

Saving, T.R., 1970. "Concentration Ratios and The Degree of Monopoly", International Economic Review, 11: 139-46.

Scherer, F.M. 1980. Industrial Market Structure and Economic Performance. Second Edition Chicago: Rand-McNally.

Schmalensee, R. 1988. "Industrial Economics: An Overview, " Economic Journal. 98: 643-681.

Simon, H.A. and Bonini, C.P., 1958. "The Size Distribution of Business Firms", American Economic Review, 48: 607-17. (Reprinted in Ijiri and Simon (1977)).

Steindl, J. 1965. Random Processes and the Growth of Firms: a study of the pareto law. London:Griffin.

Stigler, G.J., 1964, "A Theory of Oligopoly", Journal of Political Economy, 62: 44-61.

U.S., Department of Justice 1982. "Merger Guidelines", Reprinted in Antitrust Bulletin, 27: 633-665.

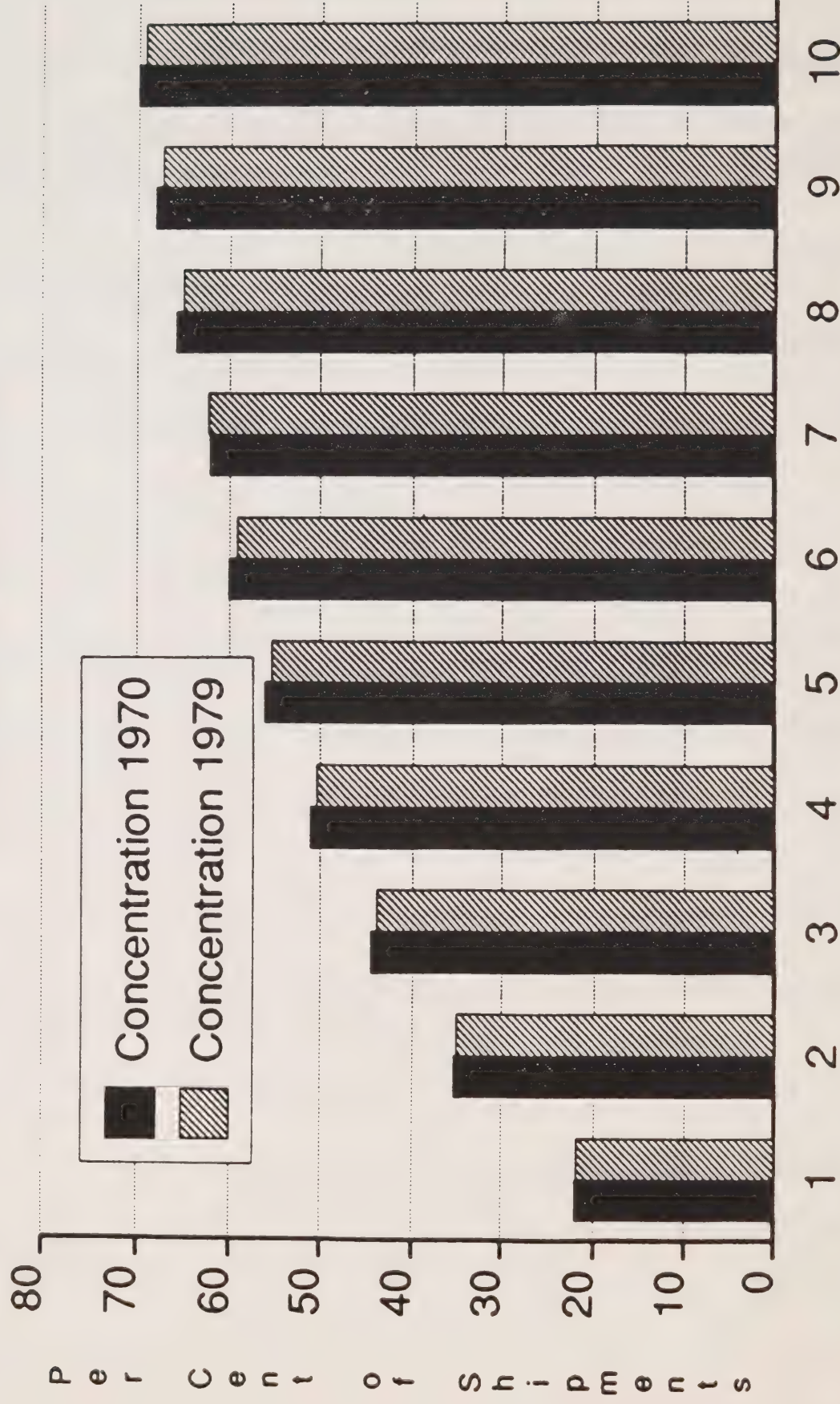
Waterson M. 1984. Economic Theory of the Industry Cambridge: Cambridge University Press.

Weiss, L.W. 1974. "The Concentration-Profits Relationship and Antitrust" in Goldshmid, Mann and Weston, eds. 184-233

Yamey, B. 1985. "Deconcentration as Antitrust Policy: The Rise and Fall of the Concentration Ratio." Rivista Internazionale de Scienze Economiche e Commerciali, 32: 119-39.

A Comparison of Concentration

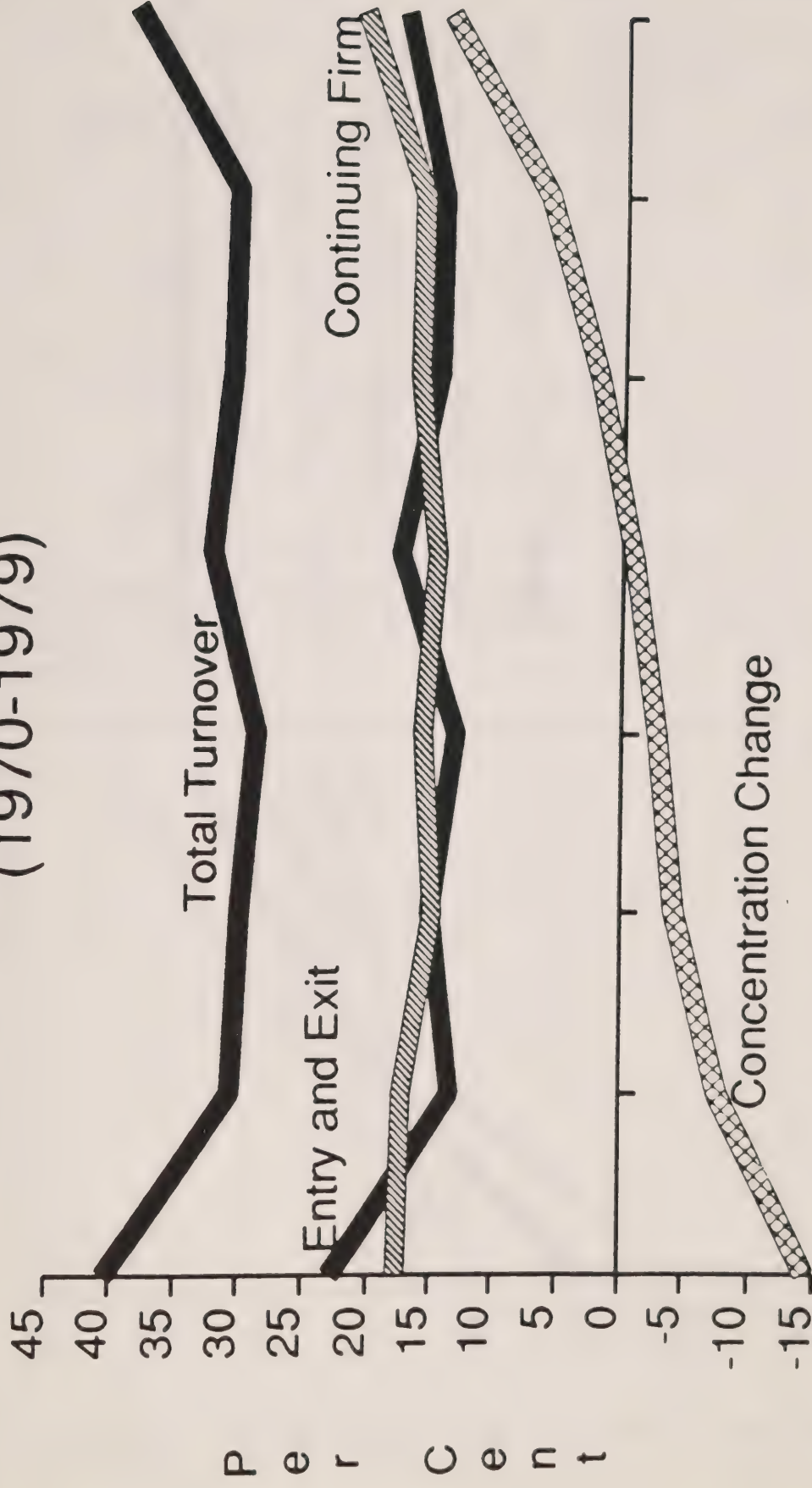
1970 versus 1979



Number of Leading Firms

Figure 1

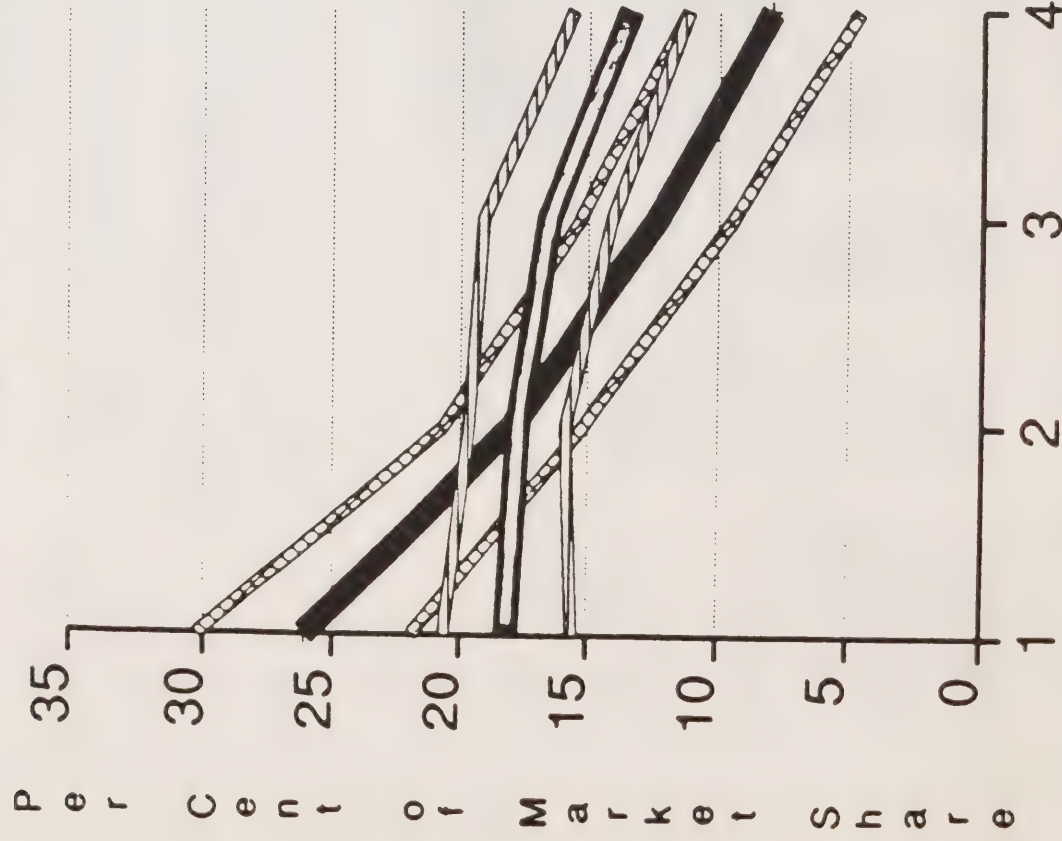
THE INTENSITY OF TURNOVER VERSUS CHANGE IN CONCENTRATION (1970-1979)



ASCENDING ORDER OF CHANGE IN CR4

FIGURE 2

Market Share Turnover by Concentration Class



Concentration Class

Figure 3

Table 1

Trends and Levels of Industry Concentration,¹ Manufacturing Sector, 167 4-digit Industries, Canada, 1970 and 1979

	1970	1979	Ratio of 1979 to 1970	
	Mean ² (Standard Deviation)	Mean ² (Standard Deviation)	Mean ² (Standard Deviation)	Median
CR4	0.5091 (0.2371)	0.4986 (0.2351)	1.0007 (0.2356)	0.979 ..
CR8	0.6546 (0.2484)	0.6442 (0.2505)	0.9929 (0.1567)	1.037 ..
HF	0.1149 (0.0956)	0.1144 (0.1119)	1.0428 (0.4440)	1.122 ..

1. CR4 and CR8 are the proportion of industry size accounted for by the leading four and eight firms, respectively. HF is the Herfindahl index of concentration. Market share is measured using shipments.
2. Unweighted mean.

Source: Special Tabulations. Business and Labour Market Analysis Group, Statistics Canada.

Table 2

The Relationship Between 1970 and 1979, Four-Firm Concentration Ratios, Manufacturing Sector, 167 4-digit Industries, Canada.

CR4, 1979						
	Frequency Percent Row PCT Col PCT	0.00-0.249	0.25-0.499	0.50-0.749	0.75-1.00	Total
CR4 1970	0.00-0.249	24	3	0	0	27
		14.37	1.80	0.00	0.00	16.17
		88.89	11.11	0.00	0.00	
		92.31	4.76	0.00	0.00	
	0.25-0.499	2	51	7	0	60
		1.20	30.54	4.19	0.00	35.93
		3.33	85.00	11.67	0.00	
		7.69	80.95	14.58	0.00	
	0.50-0.749	0	9	31	4	44
		0.00	5.39	18.56	2.40	26.35
		0.00	20.45	70.45	9.09	
		0.00	14.29	64.58	13.33	
	0.75-1.00	0	0	10	26	36
		0.00	0.00	5.99	15.57	21.56
		0.00	0.00	27.78	72.22	
		0.00	0.00	20.83	86.67	
Total		26	63	48	30	167
		15.57	37.72	28.74	17.96	100.00

Source: Special Tabulations. Business and Labour Market Analysis Group, Statistics Canada.

Table 3

The Stability of Market Structure, Selected Indicators, Manufacturing Sector, 167 4-digit Industries¹, Canada, 1970-1979

Measure of Market Structure	1970	1979	Ratio of 1979 to 1970	
	Mean	Mean	Mean	Median
<u>Upper Panel: The Size Distribution of Firms</u>				
1. Coefficient of variation of the market shares of the leading eight firms (CVAR8)				
Standard Deviation	0.7126 0.3134	0.7233 0.3490	1.1092 0.6189	0.9786
2. The marginal concentration ratio (MCR8)				
Standard Deviation	0.1455 0.0630	0.1456 0.0614	1.1740 1.4083	1.0368
3. Number of Plants (NP)				
Standard Deviation	191.1 313.1	207.1 314.3	1.1414 0.3064	1.1207
4. Number of Firms (NF)				
Standard Deviation	173.0 297.2	186.9 298.7	1.1422 0.3280	1.1125
<u>Lower Panel: Other Structural Variables</u>				
5. Minimum Efficient Plant Size as A Proportion of Industry Size ² (MES)				
Standard Deviation	0.0854 0.0854	0.0776 0.0924	0.9373 0.3144	0.9115
6. Proportion of Industry Sales accounted for by Canadian Firms (CDN)				
Standard Deviation	0.5517 0.3003	0.5889 0.2929	1.3125 ³ 1.6023	1.0502
7. Cost Structure: Proportion of Value Add Accounted for by Wages and Salaries (CST)				
Standard Deviation	0.5196 0.1266	0.4788 0.1213	0.9366 0.1939	0.9057

1. For nominal tariff protection 1978 instead of 1979

2. Minimum efficient size plant is defined as the average size of the largest plants accounting for fifty percent of industry employment. Plant size is measured in shipments.

3. Estimated for 166, since one industry had no Canadian ownership in 1970. If CDN for 1970 and 1979 are estimated for 166 rather than 167 then the mean values are 0.5517 and 0.5889, respectively

Source: Special Tabulations Business and Labour Markets Analysis Group, Statistics Canada

Table 4

The Stability of Firm Market Share, Measured using Regression and Correlation Analysis, 166 4-digit Manufacturing Industries, Canada, 1970-1979

	FREQUENCY PERCENT ROW PCT COL PCT	REGSH ⁵		TOTAL
		INCREASING DECREASING ³	STABLE ⁴	
CORSH ⁵	LOW ¹	73	30	103
		43.98	18.07	62.05
		70.87	29.13	
		64.60	56.60	
	HIGH ²	40	23	63
		24.10	13.86	37.95
		63.49	36.51	
		35.40	43.40	
	TOTAL	113	53	166
		68.07	31.93	31.93

1. Low = 0.00-0.89

2. High = 0.900-1.00

3. Increasing/Decreasing = 0.00-0.89 and 1.10 and above.

4. Stable = 0.90-1.09

5. See text for definition

Source: Special Tabulations. Business and Labour Market Analysis Group, Statistics Canada

Table 5

Rank Correlation Coefficients Between Concentration and Mobility Indices, Manufacturing Sector
166 4-digit Manufacturing Industries, Canada, 1970-1979

		CONCENTRATION INDICES ¹ (1970)		
MOBILITY INDICES ²		CR4	CR8	HF
	TURN E	-0.5884 (0.0001)	-0.5865 (0.0001)	-0.5740 (0.0001)
	TURN C	-0.1965 (0.0112)	-0.1845 (0.0173)	-0.2045 (0.0082)
	CORSH	0.5338 (0.0001)	0.4777 (0.0001)	0.5511 (0.0001)
	REGSH	0.1126 (0.1487)	0.1367 (0.0790)	0.1053 (0.1769)
	STAB1	-0.0702 (0.3691)	-0.0582 (0.4567)	-0.0682 (0.3825)

1. See text for definitions

2. The probability that the rank correlation coefficient is greater than zero is in parenthesis.

Source: Special Tabulation. Business and Labour Market Analysis Group, Statistics Canada

Table 6

The Relationship Between Concentration and Various Measure of Mobility, by Concentration Class, Manufacturing Sector, 166 4-digit Industries, Canada, 1970-1979

Concentration Measure and Class ¹	Measure of Mobility ¹			
	TURNE	TURNC	CORSH	REGSH
	Class Mean [Standard Error of Mean] (Standard Deviation)			
<u>CR4</u>				
0.00-0.2499 (27) ²	0.2608 [0.0202] (0.1052)	0.1814 [0.0121] (0.0632)	0.6302 [0.0372] (0.1932)	0.8642 [0.0408] (0.2118)
0.2500-0.4999 (60)	0.1798 [0.0139] (0.1077)	0.1775 [0.0090] (0.0699)	0.7658 [0.0225] (0.1744)	0.8826 [0.0318] (0.2463)
0.5000-0.7499 (44)	0.1239 [0.0146] (0.0969)	0.1659 [0.0125] (0.0831)	0.8169 [0.0313] (0.2077)	0.9123 [0.0244] (0.1621)
0.7500-1.000 (35)	0.0794 [0.0163] (0.0965)	0.1340 [0.0111] (0.0654)	0.9161 [0.0158] (0.0933)	0.8963 [0.0353] (0.2089)

1. See text for definition

2. Number in parenthesis refer to the number of industries classified to each class

Source: Special Tabulations. Business and Labour Market Analysis Group, Statistics Canada.

Table 7

The Top 35 Canadian Manufacturing Industries Ranked by CR4 for 1970, with Ranking also for Four Mobility Indices.¹

Concentration on Mobility Index				
CR470	TURNE	TURNC	STAB1	STAB2
<u>Ranking²</u>				
1.0	54	4.0	101	0
2.0	7	76.0	44	1
3.0	6	112.0	138	0
4.0	12	5.0	33	1
5.0	9	58.0	3	1
6.5	32	7.0	65	0
6.5	5	120.0	85	0
8.0	30	14.0	70	0
9.0	23	6.0	4	1
10.0	59	39.0	107	0
11.0	146	143.0	161	0
12.0	10	15.0	31	1
13.0	103	1.5	72	0
14.0	25	32.0	2	0
15.0	17	8.0	93	0
16.0	13	12.0	22	1
17.5	81	25.0	100	0
17.5	8	55.0	52	1
19.5	34	130.0	134	0
19.5	86	145.0	151	0
21.0	19	50.0	73	0
22.0	2	82.0	94	0
23.0	3	139.0	154	0
24.5	4	101.0	53	1
24.5	80	104.0	122	0
26.0	22	61.0	125	0
27.0	98	108.0	149	0
28.0	43	27.0	57	0
29.5	163	87.0	163	0
29.5	74	93.0	147	0
31.0	24	67.0	49	1
32.0	119	9.0	112	0
33.0	99	70.0	127	0
34.0	20	150.0	11	0
35.0	37	43.0	41	1
Proportion Ranked in Top 35 Using Given index				
100.0	60.0	34.3	17.1	43.5 ³
Means of Ranks				
18.0	44.8	64.0	86.7	..

1. See text for definition of the indices.

2. See text for ranking. A high rank of a mobility index represents greater stability, for the concentration index a higher CR4.

3. Since only 23 business had Gort=1, this is the number of industries in the top 35 with Gort=1 divided by 23.

Source: Special Tabulations. Business and Labour Market Analysis Group, Statistics Canada.

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For further information, contact the Chairperson, Publications Review Committee, Analytical Studies Branch, R.H. Coats Bldg., 24th Floor, Statistics Canada, Tunney's Pasture, Ottawa, Ontario K1A 0T6, (613) 951-8213.

